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Approach-Avoidance Behavior of Consumers as Influenced by Existing and Supplemental Merchandise Display Lighting.

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APPROACH-AVOIDANCE BEHAVIOR OF CONSUMERS AS INFLUENCED BY EXISTING AND SUPPLEMENTAL MERCHANDISE DISPLAY LIGHTING

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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ABSTRACT

This study explored the influence of lighting on consumer approach-avoidance behavior. A methodology was developed to empirically measure the approach-avoidance behavior of consumers. Supplemental lighting on merchandise displays in two non-urban retail stores was temporarily installed and manipulated On or Off to test for the effects on consumer behaviors of Time at Display, Number of Items Touched and Number of Items Picked Up. Video cameras were positioned to record consumers' actions at each display. Subjects consisted of an accidental sample of consumers who visited the field settings, a hardware store and a western/apparel feed store, during the two consecutive weekends of the study and passed within the measurement zones of the video cameras. A coding procedure, based on work by Areni and Kim (1994), was developed and used by raters who reviewed the video tapes. A total of 2367 consumers were observed, and behaviors and demographics were coded by two raters. Data were analyzed using Analysis of Variance and Bonferroni paired comparisons.

Supplemental lighting treatments did have an effect on consumer behavior, as qualified by store type. The effect of lighting on the Number of Items Touched and the Number of Items Picked Up was found to be statistically significant. The effect of lighting on the Time at Display was not statistically significant. The effect of store on Time at Display, Number of Items Touched

and Number of Items Picked Up was statistically significant. Interactions between supplemental lighting and store were found to be statistically significant.

This study provides a sound methodology for the further examination of the effect of lighting on in-store consumer behavior. Approach-avoidance theory seemed to be an effective way of explaining consumer behavior in a retail setting. This information could be useful to retailers in developing in-store lighting as part of a store's atmospherics which can aid in attracting consumers to a store and retaining consumer patronage. Further study on the effect of lighting in retail settings is recommended.

CHAPTER 1

INTRODUCTION

In-store consumer behavior is influenced by the atmospherics of the shopping environment. Store atmospherics describe the special sensory qualities of retail spaces which may have been designed to evoke particular consumer responses. Store atmospherics include visual, aural, olfactory or tactile dimensions and have been found to encourage consumers to enter a store, linger and purchase (Kotler, 1973-74).

Researchers have credited a store's atmospherics with promoting consumers' involvement within the store (Markin, Illis & Narayana, 1976). Atmospherics have also been described as one of the best tools for attracting and retaining a niche in the market and can be viewed as a form of competitive advantage for a store (Kotler, 1973-74). Store atmospherics have been shown to influence consumers' emotional states (Donovan & Rossiter, 1982). Other researchers found that consumer perception of the physical character of a store is related to consumer behavior (Grossbart, Hampton, Rammohan & Lapidus, 1990).

Particular elements of the physical environment have been studied by researchers. Increases in ambient temperature were shown to have negative effects on interpersonal behavior in a laboratory setting (Griffitt, 1970). Crowding has been shown to negatively influence consumer behavior (Grossbart et al. 1990; Harrell, Hutt & Anderson, 1980; Hui & Bateson, 1991).

Manipulation of ambient scent has been found to have a slight effect on consumer behavior (Gulas, 1995). Researchers have also studied the possibility that in-store consumer perceptions and consumer behavior can be influenced by music (Bruner, 1990; Milliman, 1982; Yalch & Spangenberg, 1990). Gobe (1990) believed that retailers should develop fragrances, sounds, music and visual excitement as a way to contribute to their stores' atmospherics. Gobe stated, "Understanding and controlling sensual clues can make 'selling through the senses' one of the most powerful strategies in retail marketing today" (p.18).

According to the literature, one of the major contributing factors influencing store atmospherics is lighting (Cuttle & Brandston, 1995; Gardner & Siomkos, 1986; Lopez, 1995; Rea, 1993). Even though the importance and benefits of lighting are generally acclaimed for retail environments, few empirical retail lighting studies have been conducted. The current research fills a void in the existing body of knowledge by empirically examining store atmospherics and consumer behavior. This study focused on the impact of lighting on consumer behavior.

Approach-avoidance behavioral theory served as the theoretical framework for this study. Mehrabian and Russell (1974) suggested that all environmental behavior could be identified as either an approach or an avoidance response. Donovan and Rossiter (1982) explained that Mehrabian and Russell's approach-avoidance theory included four aspects which can be utilized to describe consumer behavior:

> 1. A desire to stay in (approach) an environment or to get out of (avoid) the environment 2. A desire or willingness to look around and explore the environment (approach) versus a tendency to avoid moving through or interfacing with the environment or a tendency to remain inanimate in the environment (avoidance) 3. A desire or willingness to communicate with others in the environment (approach) as opposed to a tendency to avoid interacting with others or to ignore communication attempts from others (avoidance) 4. The degree of enhancement (approach) or hindrance (avoidance) of performance and satisfaction with task performances (p. 37).

Aspects 1, 2 and 4 were addressed in this study. Communication, number 3, was not addressed since this study focused on the impact of display lighting on the behavior of consumers relative to the display merchandise only and not on consumer involvement with other persons.

The three emotional states theorized to influence approach-avoidance behaviors are: pleasure, arousal and dominance, known by the acronym PAD (Mehrabian & Russell, 1974). Donovan and Rossiter (1982) determined that consumers want to stay in stores which are regarded as pleasant and arousing, and they found that these two emotional states significantly influenced retail shopping behavior.

Purpose of the Study

The overall purpose of this study was to determine the effect of lighting in retail display areas on the approach-avoidance behavior of consumers. Specifically, the influence of lighting on three aspects of approach-avoidance consumer behavior was measured: 1. a desire to approach (to remain at) the test

display or to avoid (to leave) the test display 2. a desire or willingness to explore the test display (to touch the merchandise) or to avoid the test display 3. the degree of approach (enhancement) or avoidance of the task of picking up the merchandise at the test display.

Justification

Research to quantify the impact of illumination on consumer behavior in actual retail environments could be beneficial since lighting is recognized as being an influential component, affecting consumers' visual appraisal of everything in a store, including the merchandise. Illumination has been cited in the literature as contributing to in-store consumer perception, merchandise enhancement and store success, yet few empirical studies measuring the effect of retail lighting on consumer behavior have been published (Gobe, 1990; Lopez, 1995; Rea, 1993).

Much of the work published by illumination researchers has been concerned with lighting fixture optics, physics, and color perception rather than consumer behavior in retail applications. Although most of the studies on the effects of lighting have focused on general physiological behavior and have not been specific to retail environments, one study was found that explored the influence of lighting as an aspect of store atmospherics influencing retail patronage (Baker, Levy & Grewal, 1992). Research on the effect of lighting on human behavior has focused on visual acuity or the ability of lighting to affect the productivity of visual tasks, such as those found in an office setting (Bodmann,

1962; Rea & Ouellette, 1988, 1991). Other researchers have examined college students' preferences for lighting levels for different activities but did not include shopping or other in-store consumer activities in their study (Butler & Biner, 1987).

Some studies in the area of shopping behavior relevant to store illumination have been conducted, but very few empirical measurements have been published. Most of the research studies addressing lighting relevant to consumer behavior within a retail store have been performed in controlled environments (Baker, Levy & Grewal, 1992; Gardner & Siomkos, 1986) with few conducted in actual store settings. Two studies were found that measured consumer perception of lighting within the context of actual retail stores. Consumers were surveyed regarding their perception of in-store lighting after extensive renovations were made to an existing furniture store and to an existing grocery store (Boyce, Lloyd, Eklund & Brandston, 1996; Cuttle & Brandston, 1995). Other researchers have studied consumer behavior as affected by the temporary manipulation of lighting in a wine store (Areni & Kim, 1994). Generally, the other retail studies which were found to explore consumer perception or consumer behavior in relation to various atmospheric and other environmental aspects of stores utilized memory-recall of shopping trips, photographs of retail settings, role play in imagined situations and laboratory mock-ups (Baker et al., 1992; Bitner, 1990; Butler & Biner, 1987; Gardner & Siomkos 1986). General lay publications and trade literature have encouraged retailers and store

designers to use video cameras to collect data on in-store consumer behavior (Gladwell, 1996; Rossi, 1996) but video cameras have not been widely used for in-store research.

Currently, many retailers are experiencing challenges due to increased competition and changing consumer preferences. A more appealing store with better illuminated merchandise may entice shoppers to visit the store, linger and hopefully make a purchase. According to Kotler (1973-74), buyers respond to the 'total product'. One of the most significant features of the total product is the place where it is bought or consumed. In some cases, the place, more specifically the atmosphere of the place, is more influential than the product itself in the purchase decision (p.48).

While many urban and non-urban retailers have experienced challenges in recent years, non-urban retailers have been especially affected by large discount retailers, such as Wal-mart, locating in their area. Out-shopping (out-of-town shopping) is also a grave threat to non-urban retailers. The amount of out-shopping in a non-urban area may determine the vitality of the local economy since approximately 65% of rural consumers typically out-shop (Hooper & Lipscomb, 1991; Lumpkin, Hawes & Darden, 1986). Out-shopping behavior in non-urban communities may be affected by local shoppers' satisfaction with area retail stores (Riecken & Yavas, 1988; Samli, Riecken, & Yavas, 1983). Research has shown that consumer satisfaction is related to consumers' perceptions of store image (Summers, Meyer, Douglas, Feinberg, Minshall & Wessel, 1995).

Lighting is an important component of store atmospherics which can affect store patronage, store image and consumer behavior but has not been researched in non-urban retail settings. Information to help non-urban retailers maintain existing consumer bases and attract new ones to their stores is needed. In order for non-urban retailers to survive, they must attract and retain the local consumer. They must provide the appropriate image and store atmosphere in order to do so. Research has shown that rural retailers often make decisions based on their own experiences and need more education about how to satisfy their local consumers (Carusone & Moscove, 1985). Nearly one-fourth of all American consumers currently live in non-urban areas (Kern, 1989). Non-urban stores were selected for this research. Data from actual store environments were anticipated to be more valid than findings from a laboratory setting.

Independently owned retail stores located in the small town of Gonzales, LA, which has an approximate total population of 8,312, were the sites of the current study (Louisiana Tech University College of Administration & Business, 1996). [On-line]. Available: http://www.eab.latech.edu/research/popest.htm#grant. Gonzales was within easy driving distance of the researcher's university and offered several non-urban, independently owned stores.

Hypotheses

General Hypothesis:

When the supplemental lighting treatment at the test display is illuminated, consumers' approach behavior, relative to the test display, will increase.

Specific Hypotheses:

1. When the supplemental lighting treatment at the test display is illuminated, consumers will remain at the test display longer.
2. When the supplemental lighting treatment at the test display is illuminated, consumers will touch more merchandise on the test display.
3. When the supplemental lighting treatment at the test display is illuminated, consumers will pick up more merchandise from the test display.

Assumptions

The respondents in this study were assumed to be a representative sample of all consumers although it was a non-random, accidental sample. In this experiment, consumers were selected based on which store they chose to enter. Upon review of consumer demographics and behaviors it became clear that the sample for both stores was not representative of population proportions for race or sex. White consumers comprised the majority of subjects in this study. While males and females were approximately evenly represented in the western apparel/feed store, they were disproportionately represented in the hardware store.

The time frame for the study was the month of December at the suggestion of the participating retailers in order to take advantage of the holiday-related shopping activity. Although the number of shoppers per store was higher in the western apparel/feed store and lower in the hardware store than during some other times of the year, the shopping behavior exhibited relevant to this study

was assumed to be otherwise representative of shopping behavior throughout the year.

Limitations

The study sample was limited to consumers who actually entered the store(s) in the small town of Gonzales, LA, utilized for the study and passed within view of the video camera(s) aimed at the selected merchandise displays during the period of the study. Also, due to the complex nature of purchase behavior and all of the possible influences determining whether or not consumers make a purchase, the emphasis of this study was limited to the effect of lighting on in-store shopping (remaining at the test displays, touching and picking up merchandise) behavior. Merchandise inventories were taken twice each day at the selected displays during the time frame of the study and were examined for merchandise purchase trends under the two lighting treatments. However, the researcher had no control over the items initially chosen for the display nor the frequency with which the displays were replenished. In order to remain an unobtrusive observer, the researcher did not influence the composition or layout of the merchandise displays but manipulated only the lighting treatment for the selected merchandise displays.

Definition of Terms

The following operational definitions were used in this study:

Ambient - "lighting throughout an area that produces general illumination" (Rea, 1993, p. 910).

Atmospherics - a term that "describes the conscious efforts of retailers to create buying environments to produce specific emotional effects in buyers" (James, Walker & Etzel, 1981, p. 103).

Chromacity (of a color) - "the dominant or complementary wavelength and purity aspects of the color taken together, or the aspects specified by the chromacity coordinates of the color taken together" (Rea, 1993, p. 914).

Color Rendering Index - "a measure of the degree of color shift objects undergo when illuminated by the light source as compared with those same objects when illuminated by a reference source of comparable color temperature" (Rea, 1993, p. 915).

Color Temperature (of a light source) - "the absolute temperature of a black body radiator having a chromacity equal to that of the light source" (Rea, 1993, p. 915).

Footcandle - a unit of illuminance, equal to 1 lumen/square foot or 10.76 lux (Rea, 1993).

Illuminance - "...the areal density of the luminous flux incident at a point on a surface" (Rea, 1993, p. 923).

Lamp - "a generic term for an artificial source of light" (Rea, 1993, p. 924).

Light Meter - footcandle meter or illuminance meter, an instrument for measuring illuminance on a plane" (Rea, 1993).

Luminous Flux - **"radiant flux (radiant power); the time rate of flow of radiant energy, evaluated in terms of a standardized visual response" (Rea, 1993, p. 927).**

Lux - measurement (British) of illuminance on a plane (Rea, 1993).

CHAPTER 2

REVIEW OF LITERATURE

The influence of various environmental factors on consumer behavior has been the focus of research in recent years. Multiple factors have been studied including music, physical appearance of the shopping environment, temperature, scent and lighting. The effects of background music were studied by Kellaris and Cox (1989). They performed three experiments on students in which they attempted to manipulate the subjects' choice of pens by having them associate appealing or unappealing music with the different colors of pens. These studies were based on earlier experiments by Gorn (1982). In contrast to Gorn, Kellaris and Cox (1989) found no evidence that product preferences could be influenced by a one-time presentation to music.

Other aspects of the environment were studied by Bitner (1990), who assessed the effects of atmospherics as part of a new service encounter model that she tested. She utilized 145 travelers in an airport and asked them to imagine themselves as the consumers in a negative travel situation as described in an illustrated booklet. The booklet included visual clues to environmental conditions within the travel agency responsible for the negative situation. Bitner found that there was a significant effect of physical appearance of a travel agency interior on the perception of cause in a service failure. The results of her study show that the non-verbal clues in a physical environment can influence consumer perception and satisfaction. Bitner acknowledged that generalization

of her research would be limited due to the particular setting and role playing strategy utilized. She suggested that more research into the effect of physical environment on consumer behavior was necessary in order to aid in the prediction and explanation of consumer responses.

Increases in another environmental factor, ambient temperature, were shown to have negative effects on interpersonal behavior in a laboratory setting. When subjects experienced uncomfortably warm temperatures, they were less likely to be attracted to strangers in the test setting (Griffitt, 1970).

The effect of scent on consumer preference for merchandise was examined by Gulas (1995) in a laboratory setting. Pleasant odors were not found to have a positive effect on participants' evaluation of merchandise. Pleasant odors were found, however, to have positive effects on the subjects' evaluation of the room which served as the setting for the study.

Approach-Avoidance Theory

Environmental psychology theorists, Mehrabian and Russell (1974), were interested in the prediction of people's reactions to stimuli associated with a particular place or space as influenced by their current emotional condition. They proposed a model based on a Stimulus-Organism-Response (S-O-R) paradigm that became known as the Mehrabian-Russell (M-R) model. They postulated on the effect of environment and emotions on approach-avoidance behavior. Mehrabian (1976) explained that the combined effects of pleasure, arousal and dominance influenced people's behavior in particular environments.

[Pleasure-displeasure referred to how happy a person was, arousal-nonarousal referred to the degree to which a person felt excited, stimulated alert or active and dominance-submissiveness referred to how much the individual felt in control of, or free to act in, the environment]. Mehrabian described a person who was highly aroused by his/her environment as "active, stimulated, excited, frenzied, jittery, wide awake or alert" (p. 18), and someone who is not aroused by his/her environment as "relaxed, calm, sluggish, dull, sleepy, or inattentive" (p. 19). He stated that when people are aroused, there are physiological manifestations including

> ...your brain puts out a characteristic wave pattern; blood pressure, heart and breathing rates are way up; your muscles are tense; your pupils are dilated; the blood vessels in your skin and extremities contract, so that your skin temperature is lower, you bleed less if cut, and in some cases feel less pain if there is external injury. Your entire bodily system is ready for 'fight or flight' - to cope in some vigorous way with an environment demanding extreme approach or avoidance (1976, p. 18-19).

Mehrabian (1976) additionally believed that lighting was a chief factor in the environment's impact on individuals because "brightly lit rooms are more arousing than dimly lit ones" (p. 89). Mehrabian worked with a model which he described as "...the classical 'inverted u' relationship between approach-avoidance and arousal" (p. 22), and theorized that people would want to remain in environments which were both pleasant and arousing (1976). Mehrabian (1976) proposed that in pleasant surroundings, an individual's approach behavior would increase with the arousal level. As arousal increases, approach behavior

increases. Mehrabian (1976) postulated: "...why do people shop for things they don't need or cannot afford? Our analyses of the various types of shops suggest that the single common element of the shopping experience is arousal...this suggests that people shop to increase their arousal and pleasure levels" (p. 293).

Russell and Mehrabian (1976) were interested in retail applications of approach-arousal theory. They believed that consumers were the most vulnerable to in-store influence when they felt aroused and pleasant. They theorized that retail environments could be designed to encourage these particular states in consumers. Russell and Mehrabian proposed that particular environmental influences could increase sales. In 1980, Russell and Pratt proposed modifying the Mehrabian-Russell (M-R) theory to delete the original dominance dimension. They also experimented with developing scales to assess eight of the variables shown in this model. This new model included the original terms from the M-R Model, arousal and pleasure, but eliminated the dominance dimension. Dominance was deleted because it was found to be unnecessary. Arousal and pleasure were determined to be adequate to describe people's emotions and environmental responses. Mehrabian's and Russell's research developed language, concepts and scales which they proposed be used by others studying the effect of environment on behavior as dependent variables or predictor variables.

Approach-Arousal Theory

Donovan and Rossiter (1982) were among the first researchers to apply the Mehrabian-Russell model to the retail store setting and to make predictions based on the model. They studied the connections between consumers' emotional states as influenced by retail environments and the consumers' anticipated behavior in an effort to establish actual measurements of approach-avoidance behavior in retail settings. The subjects for the study were 30 graduate students who were each randomly assigned to two or three actual retail settings. Participants visited each retail store on a different day and time of day. There were 66 total observations. While visiting the retail settings, respondents completed questionnaires which assessed their in-store emotional states, the stores' perceived environmental attributes and complexity, and the participants' retail shopping intentions. The emotional states questions included pleasure, arousal and dominance dimensions. Environmental attribute questions pertained to store atmospherics. The shopping intention questions measured approach-avoidance. The respondents rated 18 pleasure, arousal and dominance measures, 14 atmospheric attributes and 8 approach-avoidance and spending factors. Consistent with previous studies, Donovan and Rossiter (1982) found the dominance factor to be insignificant. Reliability coefficients for pleasure and arousal, however, were high. The researchers reported reasonable support for the pleasure-arousal interaction hypothesis. In pleasant retail settings, arousal was a significant predictor of approach intentions for time and affiliation.

"...given a pleasant retail store atmosphere, arousal now becomes the key mediator of intentions to spend time in the store" (p. 50). Donovan and Rossiter (1982) also reported that for pleasant retail environments, arousal was a significant predictor of approach intentions. These researchers did not study the effect of lighting per se, but rather the total environment.

Donovan, Rossiter, Marcoolyn and Nesdale presented a modified Mehrabian Russell (M-R) environmental model in their 1994 paper. They, too, eliminated the dominance component proposed in the earlier model because of a lack of empirical evidence and theoretical reasons. Sixty female consumers at two different actual retail store locations were approached at random and asked about the amount of time that they intended to spend in a particular store. After shopping for five minutes, these consumers were asked to rate their pleasure and arousal. After shopping, the consumers were asked to divulge the amount of money that they spent in the stores. The researchers found that the pleasantness of in-store atmospherics was a significant predictor of desire to approach or remain in the store and to spend money. Arousal was found to vary in its influence in this study.

Researchers, Areni and Kim (1994), cited Mehrabian's (1976) interpretation of the influence of lighting on arousal. Areni and Kim (1994) also cited Birren (1969) who advocates the use of "really bright light" for impulse merchandise because a high level of arousal would encourage impulse purchasing. Areni and Kim (1994) pointed out, however, that conflicting with arousal theory, visual

acuity theory makes different predictions in reference to the effect of lighting on behavior. They based their field study of the effect of lighting on consumer behavior in a wine store on both arousal theory as well as visual acuity theory frameworks. They studied the impact of in-store lighting on shopping behavior utilizing a convenience sample of 171 wine store consumers over a sixteen night period. They manipulated the merchandise lighting (soft or bright) on different evenings by replacing some of the store's existing lamps with lower wattages. The researchers did not publish the wine store's before and after footcandle levels nor any other empirical lighting measurements for the two lighting settings, but rather, relied on the perceptions of the wine store employees to determine that an adequate difference was created. The absence of empirical measurements and physical store documentation makes replication of this study in other store settings very difficult.

To record consumer behaviors, Areni and Kim (1994) used a modified version of an instrument developed by Hoyer (1984). Hoyer's (1984) original instrument included a system for documenting and coding, allowing a rater to quickly record consumers' in-store behavior in relation to the merchandise's original location on a display shelf. Hoyer studied the number of packages of laundry detergent that were examined, picked up, and purchased by 120 consumers as well as the amount of time spent in seconds on particular in-store behavior. Raters observed consumers' appearance and identified their sex and race.

In an attempt to compensate for their non-random experimental design, Areni and Kim (1994) utilized a counterbalanced design and completely crossed the day of the week by the soft or bright lighting condition with individual consumers nested within day of the week. They utilized ANOVAS with time spent in minutes, number of items examined, number of items handled and number of items purchased and reported on these factors. Reported behaviors included the number of items that consumers visually examined, physically handled and purchased. Concerned with possible threats to internal validity created by local events influencing the total number of store consumers, average behaviors rather than total behaviors were used to represent a given night's behaviors. This research relied on a case study utilizing one retail setting only. One observer posing as an inventory clerk recorded his/her observations of consumer behavior within the wine store. Areni and Kim (1994) found that consumers examined and handled significantly more items under bright lighting conditions than under soft lighting conditions. Also, couples were found to spend more time in the cellar area of the wine store than other groups of consumers. The effect of lighting on the amount of time couples spent in the cellar, the number of items purchased and the total sales were not found to be significant.

Other Illumination Field Studies

Only a few additional illumination field studies utilizing retail store settings were found. Two of these studies focused on sales, consumer perception, and

proprietor or sales staff perceptions of physical modifications to existing stores and not on actual in-store consumer behavior (Cuttle & Brandston, 1995; Boyce et al., 1996). These were also case studies, but they additionally documented and justified actual store improvements made by the designers/researchers. In both studies, store modifications were motivated by a desire to increase sales and reduce operating costs in order to make the stores more competitive. Both studies measured the impact of the lighting on changes in electricity consumed by each store, customer and proprietor or staff's perceptions, and merchandise sales. The designers/researchers, Cuttle and Brandston (1995) and Boyce, et al. (1996) participated in the design of the actual interior renovation of the existing stores which were used for the studies. In one of the studies, the designers/researchers stated that they were interested in "quantifying the benefits of good lighting to retailers..." (Boyce et al, 1996, p. 1).

In Cuttle and Brandston's study (1995) which utilized a furniture store, the designers/researchers were asked

> ...to propose a program for developing an appropriate design for relighting part of the store, supervising installation of the new lighting, and monitoring its performance. The performance monitoring was to include assessment of the lighting as it influenced sales, user attitudes, energy use and operating costs (p. 33).

The designers/researchers experimented with various lighting design solutions through mock-ups before installing their final choice. Their new lighting raised the light level in the store's two galleries 170% and 120% from 180 lux each to

490 lux and 400 lux respectively. The relighting solutions of the two galleries were unique to each other, but both included changes in the lighting source, lighting color temperature, lighting color rendering index, lighting technique, lighting fixture mounting, lighting fixture housing material and style. These new lighting solutions consisted of custom designed lighting fixtures (Cuttle & Brandston, 1995).

Cuttle and Brandston (1995) made a series of empirical measurements to determine the illumination levels in the horizontal and vertical planes of this store. Additionally, the designers/researchers reviewed the electrical power density figures and the initial and maintenance costs of both of the galleries' newly installed lighting systems. The designers/researchers also examined sales figures for furniture sold under both the new and old lighting for trends but admitted that this was a difficult task due to many intervening factors. They reported, however, that in one of the renovated furniture galleries, they could attribute a 35% increase in sales to relighting, but that in the other renovated gallery they could not identify a trend (Cuttle & Brandston, 1995).

In addition to empirical measurements, Cuttle and Brandston (1995) gathered perception data by having the furniture store's staff administer 327 consumer questionnaires. They found that consumers preferred the new lighting in both galleries to the old lighting and preferred one of the newly-lit galleries over the other newly-lit gallery. Fifteen of the store's 35 employees also completed perception surveys, and the results showed they also preferred the

new lighting in both galleries to the old but did not express preference for one of the newly lit galleries over the other (Cuttle & Brandston, 1995).

In 1996, Boyce et al. reported on the impact of their lighting renovation of a grocery store on consumer perceptions, electrical power consumption and sales. Consumer reactions were measured by surveying 265 consumers before and 279 consumers after the lighting renovations were made. Sales data were reviewed in order to determine trends which could have been influenced by the lighting changes. The store's proprietor was interviewed in order to obtain his opinion on the lighting renovation.

Boyce and his co-authors (1996) admitted that there were several intervening variables which complicated their study. When the lighting was changed, other interior modifications to the grocery store were also made. This increased the difficulty in measuring the effect of the lighting alone on perception and sales. Additionally, the store owner likely had a vested interest in a positive opinion of his newly renovated store. The validity and even the importance of his opinion is questionable from a research standpoint, although his feedback would be considered essential from a designer's viewpoint. The manner in which consumer lighting opinions were measured is also questionable. Lighting is difficult for consumers to describe and is not usually intended by designers to be noticed or evaluated per se.

Further, although sales data were reviewed by Boyce and his co-researchers (1996), it would be difficult to attribute increased sales for certain remodeled

areas of the store to the new lighting alone and not to a combination of other factors associated with the initial reopening of the grocery store. Also, items such as the actual profit margin for certain areas of the store were considered a trade secret and were not made available to the researchers. The researchers therefore made "rough estimates" (p. 15) regarding "the simple payback period for the cost of remodeling" (p. 15). They also discussed "smoothing" (p. 8) the data and adjusting for inflation. The designers/researchers reported that the grocery store owner was very pleased with the new lighting for his store. Consumers were also pleased with the new lighting and thought that it was brighter and more comfortable than before. Although none of the other lighting modifications were related to significant increases in dollar sales, increases in number of consumers present or increases in items sold in other areas of the grocery store, the designers/researchers found a significant increase in dollar sales for the bakery area after the relighting (Boyce, et al., 1996).

Cuttle and Brandston (1995) and Boyce and his co-researchers (1996) investigated consumer perception of new retail store lighting after major interior renovations were made to actual stores. However, the validity in asking consumers to meaningfully assess retail stores' illumination is questionable. The argument can be made that consumers do not normally notice retail lighting per se, nor are they qualified to adequately describe or evaluate illumination. Much of lighting's effects and components are difficult for the average consumer to describe, and his/her illumination vocabulary is usually extremely limited. Some

terms, such as brightness, may mean different things to lighting experts and consumers. Further, the purpose of retail lighting, in addition to making the space more aesthetic and functional, can be to elicit particular behaviors, often without the consumers' knowledge.

Industry Recommendations

The Illuminating Engineering Society of North America (IES) Handbook states that "the primary goals common in the lighting of merchandise are to attract the consumer, to initiate purchases and to facilitate the completion of the sale" (Rea, 1993). Asking consumers questions which draw their attention exclusively to the lighting is unusual from a design standpoint.

The IES published a chapter on merchandise lighting in their handbook (Rea, 1993) in which design recommendations concerning the quality and quantity of light for retail applications were made. These recommendations address light source types, color rendering capacities, color temperatures, lighting techniques, footcandle or lux levels, lighting controls, energy consumption, operation, and maintenance. These recommendations have been contributed by practicing lighting designers, store planners, interior designers, lighting and lamp manufacturers, scientists, and other experts.

One researcher's field study documented and compared the lighting quality and quantity in the merchandising areas and fitting rooms of three stores to the IES recommendations for merchandising spaces (Hegde, 1996). Measurements were taken with an illumination meter capable of measuring both the quality and

quantity of light. Hegde found that the lighting in the three stores was inadequate as compared to the IES recommendations for color rendering index and illuminance levels with the most significant discrepancy in the illuminance levels. The color temperature of the light was found to be adequate. Hegde surmised that these stores' retailers did not understand the potential consequences of poor in-store illumination with regard to consumer appraisal and purchase of merchandise. Hegde suggested further experimental research on light and its effect on consumer behavior.

The IES also discusses pleasure and arousal in their literature. The Society recommended that when illuminating merchandising spaces, lighting designers should create a "pleasant and secure environment to do business" (Rea, 1993, p. 591). The IES also discusses strategies for creating a pleasant impression for different kinds of spaces, including the use of non-uniform lighting and special illumination of perimeter wall areas. However, in contrast with Mehrabian (1976), the IES indicates that while some studied illuminances may produce more arousal in human males than in human females, there is as yet no physiological data to support the supposed connection between lighting and physiological arousal (Rea, 1993). The IES vocabulary and qualitative and quantitative standards could be used by researchers to document and compare lighting from study to study.

CHAPTER 3

METHODOLOGY

Illumination is often employed by lighting designers, architects, interior designers, and store planners to support and enhance the merchandise in retail stores and to encourage or reinforce consumer behavior. Lighting also functions to compliment the retail architecture, but illumination is not usually intended to be a dominant element to be noticed per se by consumers in a retail setting. Therefore, the in-field manipulation of illumination in actual retail store situations, and the documentation of resulting consumer behavior in response to the lighting, would lend a much needed contribution to the literature. Since drawing special attention to retail stores' illumination by surveying consumers with perception questions could hinder some of the retail lighting's intended behavioral cues, this study used observations of consumer behavior.

The review of literature supported the use of approach-avoidance theory, and two of its main attributes, pleasure and arousal, were used to determine the study's independent variables. Mehrabian (1976) theorized that brighter light increased arousal and that the combination of pleasantness and arousal made individuals more susceptible to influence. In this study the "influence" to which the individuals were subjected was the stores' merchandise. The merchandise lighting may help to create a pleasant and arousing environment at the merchandise display and encourage the consumers to approach. The instrument

and observational measurements were based on those used in the Areni and Kim (1994) study.

The Study

Research design

Participating retailers for the study were selected based on their willingness to allow a temporary supplemental lighting system to be installed over one of their merchandise displays; to allow for the On or Off treatment of this temporary lighting system to be administered alternating daily during their normal operating hours; to allow their consumers to be observed and recorded via videotape; and to allow access to their stores and merchandise displays. Stores also had to exhibit substantial consumer activity and a minimum of daylight intrusion to be considered. Daylight intrusion was an important consideration because, depending upon the amount which was allowed to enter a store at different times of day and depending upon climatic conditions, the overall store ambient lighting level could vary over the course of the study.

Two stores were selected for the study which were located in non-urban areas and were independently owned. Two different types of retail establishments, a hardware store and a western apparel/feed store, were selected as settings to test the effects of supplemental lighting treatments on consumer behavior. Both types of stores, the hardware store and the western apparel/feed store, could be expected to be found in other non-urban areas. Consumers in these two stores were studied for two consecutive Fridays and Saturdays, and

were evaluated by raters. Observations of 2367 consumers were recorded and deemed usable.

Store Layout and Finishes

The supplemental lighting and test display locations and configurations in each of the two stores, and the test displays' relationships to important elements in the stores' interiors (store entrance, video cameras, cash wrap area) were documented. The test display for the hardware store was a tool display and the test display for the western apparel/feed store was a belt display. Physical measurements were taken of these test displays and the immediate surrounding areas in the stores with a tape measure and were recorded on measured drawings shown in Figures 1 and 2. In-store ceiling heights were also measured with a tape measure and found to be 10'-0" above finished floor in the hardware store and 8'-0" above finished floor in the western apparel/feed store.

Physical descriptions of the interior finish materials and of their light reflectance values were documented. Light reflectance values (LRV) were determined through the visual inspection and matching of major room surface finishes in the two stores to a set of color paint chips whose light reflectance values were published (Sherwin Williams, 1996). The light reflectance values for the major surfaces in the hardware store were determined to be as follows: acoustical tile ceiling, 71%; painted gypsum board walls, 68%; and terrazzo floor, 37%. The light reflectance values for the major surfaces in the western

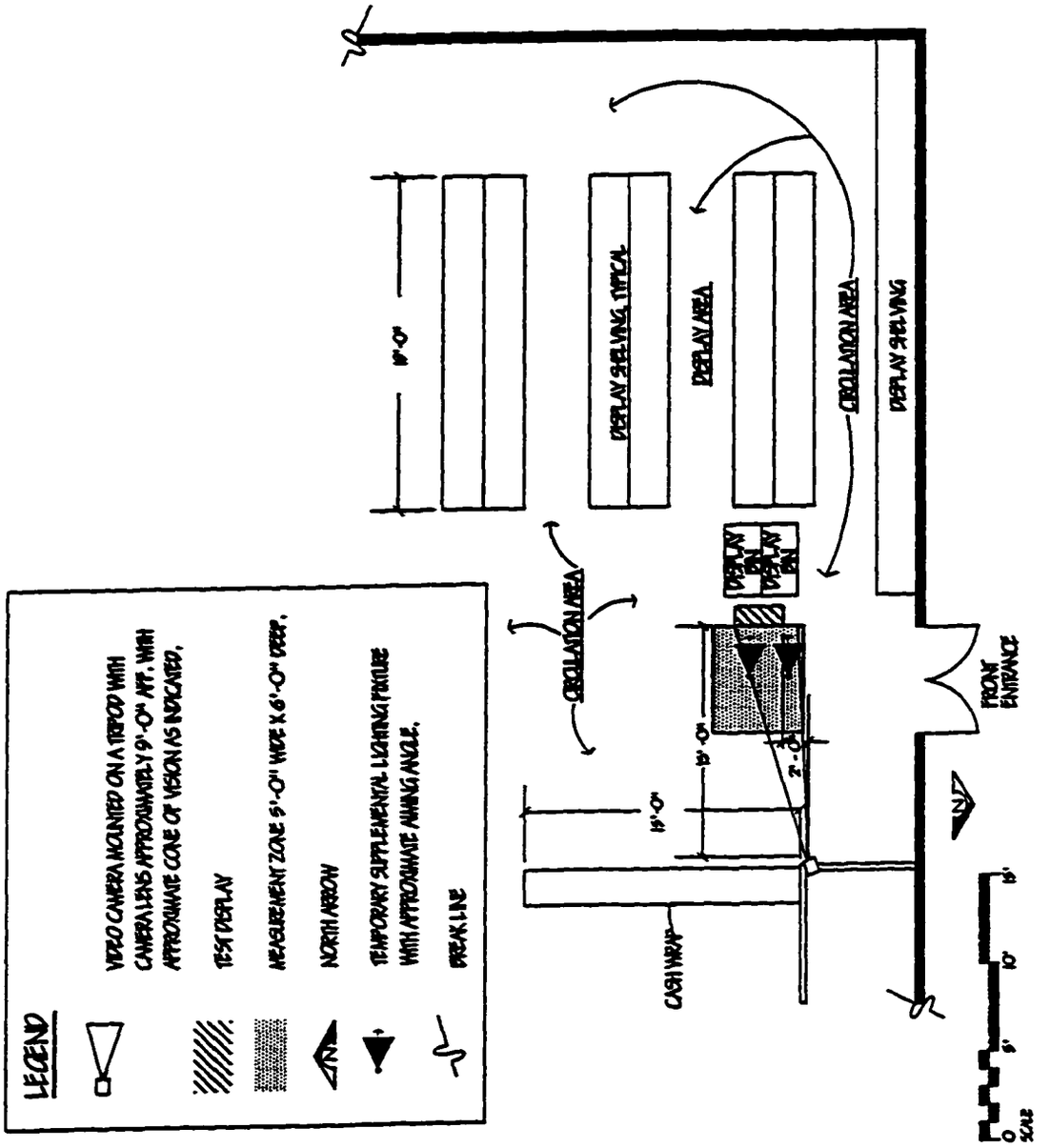

Figure 1. Floor Plan of Hardware Store.

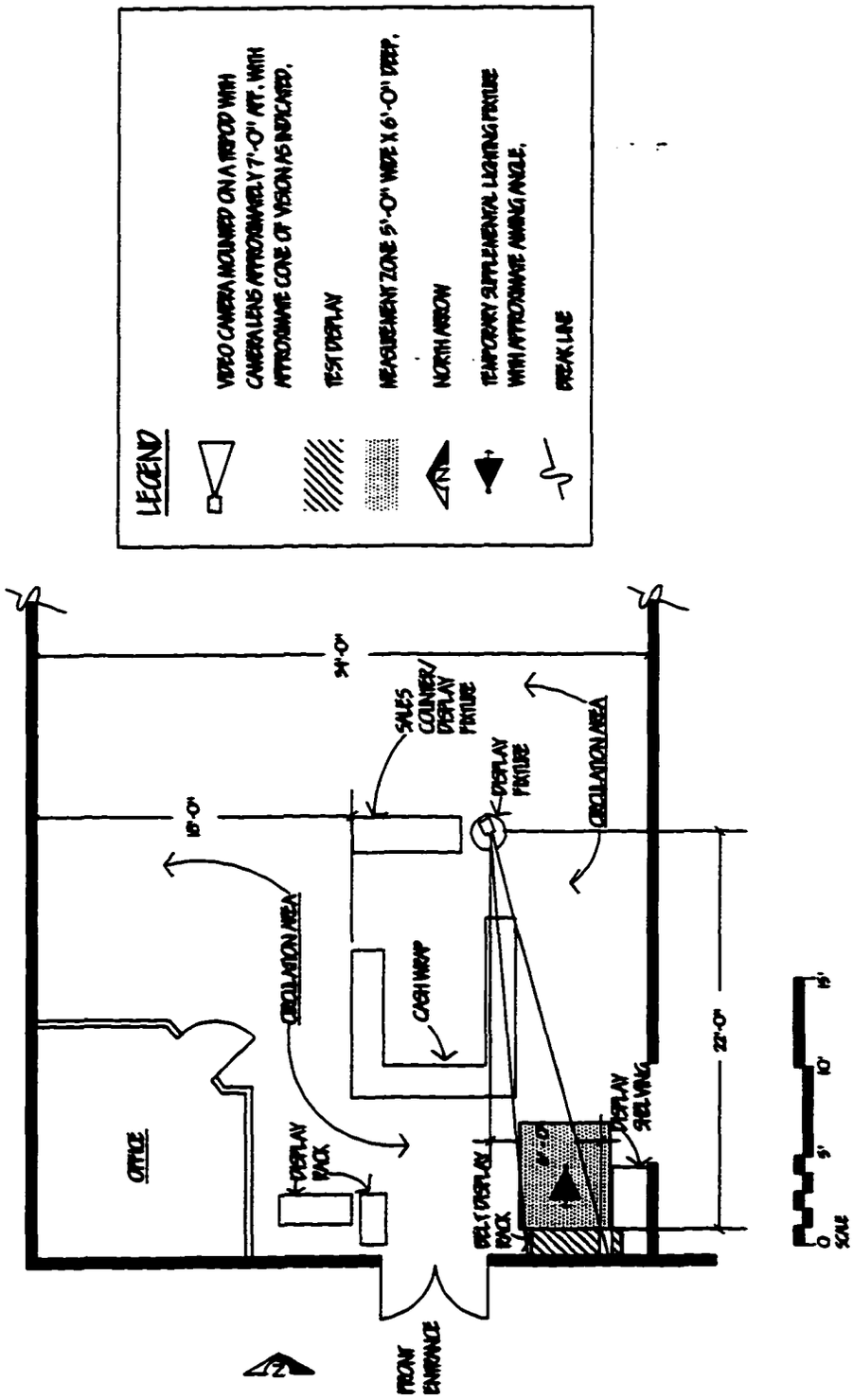

Figure 2. Floor Plan of Western Apparel/Feed Store.

apparel/feed store were found to be as follows: wood ceiling, 14%; painted gypsum board walls, 74%; and vinyl tile floor, 74%.

Lighting Fixtures and Lamps

The existing ambient lighting in the hardware store at the time of the study may be described as 8'-0" long double lamp profile exposed bare lamp strips surface mounted to the ceiling and lamped with 75 watt General Electric Cool White fluorescent lamps. The existing ambient lighting in the western apparel/feed store at the time of the study may be described as 8'-0" long double lamp profile exposed bare lamp strips surface mounted to the ceiling and lamped with 60 watt Sylvania Super Saver Designer fluorescent lamps.

The temporary, supplemental test display illumination for both of the stores in the study was provided by inexpensive, readily obtainable, utilitarian floodlight fixtures installed by the researcher. The exact quantity, location and aiming of these lighting fixtures were determined after in-store tests were performed. While working within the constraints of the existing store, the researcher succeeded in achieving lighting quantity and quality similar to IES recommended light levels for hardware and apparel merchandising spaces with the temporary supplemental illumination. The resulting installation consisted of two fixtures in the hardware store and one fixture in the western apparel/feed store. The fixtures provided were 7" x 5", lensed, 500 watt quartz fixtures each lamped with one quartz tubular Designers Edge 500 watt T-4 lamp. These fixtures were

temporarily mounted to the ceiling over the test displays and aimed at the merchandise on the displays.

Quantity of Illuminance

All field lighting measurements were made following the methodology recommended by the Illuminating Engineering Society of North America and all comparisons were made to IES references (Recommended practice for lighting merchandising areas: a store lighting guide, 1997). Measurements of the existing footcandles were made with a light meter in the vertical plane of the merchandise displays. These measurements were taken under actual conditions consisting of a combination of daylight and electric light. Light levels were metered both with and without the supplemental temporary lighting system contribution (On and Off treatments). A Sylvania digital meter model number DS-2000 was used. Both stores in the study were normally open only during the daytime. The footcandle measurements taken in these stores were also compared to the IES recommendations for merchandising spaces.

In the hardware store, the average ambient light level was measured to be 22.45 footcandles. The IES recommended ambient level is 10 footcandles. The average light level measured on the test display with the Off treatment was 23.64 footcandles. With the On treatment 47 footcandles was measured. The IES recommended level for merchandise display illumination for low activity areas is 30 footcandles. Due to the hardware store's presence of approximately one-half

of the consumer traffic found in the western apparel/feed store, the hardware store was classified by the researcher for this study as a low activity area.

In the western apparel/feed store, the average ambient light level was measured as 37.31 footcandles, and the IES recommendation is 20 footcandles. The average light level measured on the test display with the Off supplemental lighting treatment was 23.21 footcandles. With the On treatment 72.35 footcandles were measured. The IES recommended level for specialty stores, considered a medium activity level by the IES, is 75 footcandles.

Quality of Illuminance

Color temperature is the color of the light source, itself. Correlated color temperature is a precise scale and was defined to be "the color gradation of the light...compared with the light emitted by an intensely heated iron bar of which the temperature is known" (Philips Lighting Application Guide: Retail Lighting, 1991), p. 36. In this way, the color of a light source can be specified by a value in Kelvin. Lower values indicate warmer light sources, higher values indicate cooler light sources (Philips Lighting Application Guide: Retail Lighting, 1991).

Color temperatures of the light sources in this study were determined by visual inspection of information imprinted on in-store lamps and by referring to charts of lamp characteristics (General Electric Spectrum 9200 Lamp Catalog, 1995 & Osram Sylvania Product Catalog, 1996). IES recommendations for color temperature in ambient and merchandise display areas for stores were used for comparison. The IES recommendations for color temperature are on a three

point scale for stores: 1. low-end, mass merchandising, 2. Middle and 3. High-end (Recommended practice for lighting merchandising areas: a store lighting guide, 1997). Recommended color temperatures for both stores used for comparisons in this study were taken from the middle category. The color temperatures of the light sources aimed at the test display in both stores were found to be 2950 degrees Kelvin, and the IES recommendation is 3000-3500 degrees Kelvin (Recommended practice for lighting merchandising areas: a store lighting guide, 1997). In the hardware store, the ambient color temperature was found to be 4150, and the IES recommended color temperature is 3000-3500 (Recommended practice for lighting merchandising areas: a store lighting guide, 1997). In the western apparel/feed store, the ambient color temperature was found to be 3000 and the IES recommendation is 3000-3500 (Recommended practice for lighting merchandising areas: a store lighting guide, 1997).

Color Rendering Index is based on a standardized scale and all lighting sources are assigned a value for it between 0 and 100. When a light source with a higher color rendering index is utilized, colors appear better, truer and more natural. Color rendering index and color temperature are completely independent of each other (Philips Lighting Application Guide: Retail Lighting, 1991).

The color rendering indices of the light sources in this study were determined by visual inspection of information imprinted on in-store lamps and by referring to charts of lamp characteristics (General Electric Spectrum 9200

Lamp Catalog, 1995 & Osram Sylvania Product Catalog, 1996). IES recommends color rendering indices for light sources in all selling areas to be rated 70 or higher (Recommended practice for lighting merchandising areas: a store lighting guide, 1997). The color temperature of the ambient lighting in the hardware store was 62. The color temperature of the ambient lighting in the western apparel/feed store was 70. The color rendering indices for the On supplemental lighting treatments for both stores was determined to be 100. The merchandise on the test displays in both the hardware store and the western apparel/feed store selected for this study appeared to be non-color-critical due to the preponderance of metallic materials, brown and black leathers and black and other dark finished materials. Less in evidence were the more color sensitive hues, such as reds and blues.

Sampling Procedures

To help to control for the many possible extraneous independent variables, including particular town events, seasonal activities or weather which could either encourage or discourage shopping, measurements for this study were performed in two separate retail store locations during the same time period. Video cameras were utilized to perform the role of impartial observers and to create a permanent documentation of the data.

The sample included consumers who visited the participating retail stores and were recorded via video tape remaining at the merchandise display, touching merchandise or picking up merchandise during the period of the current study.

The first variable, Time at Display, was measured by the number of seconds that consumers stood or walked in front of the test display with their head and/or body turned in the general direction of the merchandise display of interest and were recorded by the video camera. The zone of measurement for remaining in both the hardware store and apparel/feed store was approximately 5'-0" wide (across the display) and up to 6'-0" deep in front of the display as shown in Figures 1 and 2. The second and third dependent variables in this study were measured by counting the Number of Items Touched by consumers on the test display and the Number of Items Picked Up by consumers from the test display.

Data Collection

After the installation of the temporary, supplemental lighting system at the test displays in each of the two chosen stores, the researcher turned the lighting treatment On or Off daily, alternating the On or Off lighting treatment each Friday and Saturday for 8 hours per day per display. The lighting treatments were counterbalanced such that the On lighting treatment was administered once for a Friday for both stores at the same time and once for a Saturday for both stores at the same time and the Off treatment was administered once for a Friday for both stores at the same time and once for a Saturday for both stores at the same time. The counterbalance was introduced into the experimental design by beginning the first Friday - Saturday sequence with the Off lighting treatment and beginning the second Friday - Saturday sequence with the On lighting treatment.

Shopping behaviors were recorded by one video camera positioned in the ceiling near the selected display in each of the two stores. In the hardware store, an existing in-store surveillance video camera which was already in a location appropriate to capture consumer behavior at the selected merchandise display, was utilized for this study. In the western apparel/feed store, the existing surveillance camera was not aimed in an appropriate direction; and, therefore, a portable video camera was temporarily installed for this study. The location of the video cameras in each store setting is shown in Figures 1 and 2.

Subjects

The subjects for this study included all consumers who visited the selected stores during the specified time period of the study, passed in front of the displays (unless their heads were turned away from the displays as they walked or stood in front of the displays) and were recorded on videotape. The two stores included a hardware store and a western apparel/feed store in Gonzales, LA. Relevant participant demographics including race, sex, and age range in decades were indicated by viewing the videotapes off-site. During the 4 days of the study, 2367 participants were observed.

The request for use of human subjects was approved. See Appendix 1. This project was granted an exemption review by the Louisiana State University Institutional Review Board (IRB) because this research was conducted in public places and did not include any of several elements with which the board would have been concerned. Human subjects cannot be identified directly nor through

identifiers linked to the subject. The research did not involve the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens. This was not a research or demonstration project conducted by or subject to the direct approval of the head of Health and Human Services or other federal agency. This project did not include a taste or food evaluation or consumer acceptance study.

Data Recording

After the video tapes were recorded and collected, they were watched off-site on a wide-screen television, and the consumer behaviors of interest were counted, timed and recorded by the researcher concurrently with one other rater using the Consumer Behavior Code Sheet. This instrument, shown in Figure 3, was derived, with modifications, from the instrument developed by Hoyer (1984) and later modified by Areni and Kim (1994). The instrument was designed to facilitate recording information from the field setting for the study, demographic data on the subjects and behavioral data on the subjects.

The following information was recorded on the video tape labels at the time of their creation: the day of the week, the date, the store code (1 for the hardware store or 2 for the western apparel/feed store) and the supplemental lighting treatment code (1 for On or 2 for Off). This information was transferred to the Consumer Behavior Code Sheets as videos were reviewed.

A consumer identification code was assigned sequentially to each new consumer observed on the video tape. If a consumer returned after a time of

Day: _____ Date: _____ Store Number: _____

Customer #: _____

Supplemental Lighting Treatment (circle one): 1 2

1. Time at Display in seconds: _____

2. Number of Items Touched: _____

3. Number of Items Picked Up: _____

4. Sex (circle one): Male Female

5. Approximate Consumer Age (circle one):

12 or younger 13-19 20-39 40-59 60+

6. Race (circle one): White Black

Other, Describe _____

Figure 3. Consumer Behavior Code Sheet.

departure from the video tape, his/her additional behaviors were added to his/her initial behaviors on the same instrument unless more than three minutes had elapsed. If more than three minutes had passed, a new instrument was started for the new behaviors. The Time at Display that consumers remained was determined from watching a hand-held digital timer and recording the total number of seconds. The Number of Items Touched by consumers at the test display and the Number of Items Picked Up by consumers from the test display was counted and recorded on the instrument. The sex of the consumer was identified. The approximate age range of the consumer was identified. Categories of ages were created for the purpose of analysis. (1 = 12 or younger, 2 = 13 - 19 years old, 3 = 20 - 39 years old, 4 = 40 - 59 years old and 5 = 60 and older). Race was identified (white, black, or other).

The rewind and play options on the video tape player allowed for the separation of multiple consumers' behaviors which had been captured simultaneously. Video tapes also allowed for the replay of difficult-to-follow (or rapid) consumer behavior. The data were collected during December 1996.

Methods Tests

To determine the feasibility of the methodology for this study, methods tests were performed prior to data collection. These methods tests were utilized to minimize and control for possible equipment limitations and to practice the recording and coding of consumer behavior. In Methods Test 1, a temporary merchandise display was set up in the lobby of the Louisiana State University

School of Human Ecology Building. This test display included clothed bustforms, apparel, sports equipment, accessories and props relating to athletic pursuits. These were grouped and displayed on a table, similar to an in-store vignette. The test display included supplemental, temporary illumination. Inexpensive, aluminum, reflector-type industrial lighting fixtures were purchased at a local hardware store, lamped with 150 watt reflector lamps and temporarily mounted to the front edge of the table holding the test display. A video camera was concealed behind an existing partition approximately 20'-0" from the test display and inconspicuously trained on the test display for approximately 3 hours. Only the On lighting treatment was tested. The behavior of persons in the test display area was captured via videotape, and later reviewed and recorded using the Consumer Behavior Code Sheet. The researcher also observed first-hand, from a discrete distance, in order to listen for comments and to be on-hand to change the tapes or make necessary adjustments to equipment. The lighting fixtures were found to be inadequate with regard to ease of mounting and aiming. Upon visual inspection by the researcher, the light level produced by these fixtures was also determined to be too weak. The video camera successfully recorded consumer behaviors of interest that were able to be evaluated using the Consumer Behavior Code Sheet.

Following the conclusion of Methods Test 1, the equipment was reviewed and refined for use in Methods Test 2. A Baton Rouge-based, independently owned apparel consignment shop agreed to participate in Methods Test 2. An

existing in-store merchandise display was selected and two temporary, supplemental lighting fixtures were hung above this display from retailer-provided ceiling clamps attached to the lay-in acoustical tile ceiling runners. The same aluminum reflector fixtures that were utilized in Methods Test 1 were used and were aimed down at approximately 45 degree angles to the test display. These fixtures were fitted with more powerful lamps than in Methods Test 1. One hundred and fifty watt parabolic aluminized reflector encapsulated incandescent lamps were utilized. The video camera was positioned in the cash wrap area approximately 10'-0" from the test display, and shopping behavior at the test display area was recorded for three hours. Only the On treatment was tested. No attempt was made to conceal the video camera as the store owner insisted that her consumers would not notice it if it were mounted in the cash wrap area. This mounting site also provided some security for the camera itself as the cash wrap area was continually manned by employees. Consumer behaviors were observed first-hand from behind the cash wrap area by the researcher posing as an employee. None of the consumers appeared to take notice of the video camera. The video tape adequately recorded data about consumer shopping behavior which the researcher was able to evaluate using the Consumer Behavior Code Sheet. The video tape captured the consumer behaviors at the test display remaining, touching merchandise and picking up merchandise.

The lighting fixtures' position above the displays yielded better results in illuminating the merchandise than the adjacent mount to the display table as used in Methods Test 1. While the light level in Methods Test 2 appeared to be higher than in Methods Test 1, the supplemental lighting still did not produce adequate contrast on the merchandise when compared to the existing ambient light level. As a result, inexpensive, portable industrial type lighting fixtures with more powerful quartz lamps were purchased at a local home improvement store for use in Methods Test 3.

Methods Test 3 was performed to check the new lighting fixtures in another retail store setting, a small tennis pro shop. The video camera was positioned on the top shelf of an apparel display fixture approximately 8'-0" behind and to the left of the test display, and shopping behavior at the test display area was recorded for three hours. The new, supplemental temporary On lighting treatment produced a noticeably different visual effect on the merchandise than the existing ambient lighting (Off lighting treatment). These new fixtures contained 500 watt quartz tubes and were physically more substantial than their predecessors utilized in the prior methods tests. The mounting devices on these fixtures allowed for more ease and flexibility in mounting and aiming. Their higher wattage and quartz type of lamp allowed for higher light levels on the test displays, allowing them to meet IES recommendations for merchandising spaces. Approximately 75 footcandles average were achieved on the vertical surface of the test display. The warm color temperatures and high color rendering indices

of the lamps utilized produced a pleasantly inviting ambience and flattered the test display merchandise's colors and textures. The low cost and easy availability of these fixtures were important in order to help assure independent, non-urban retailers that lighting effects which can positively influence consumer behavior do not have to be cost prohibitive. The use of these temporary, inexpensive fixtures helped to show that the exact style and installation of lighting fixtures were less important than the quality and quantity of light on the merchandise. Utilizing these fixtures, fewer problems were encountered and consumer behaviors were able to be coded using the Consumer Behavior Code Sheet.

Pre-test

A test, identical to that of the actual study, was performed in both the hardware store and western apparel/feed store, for one day only in order to confirm camera locations, lighting level adequacy, and equipment operation. The test was successful and consumer behaviors were video taped and viewed off-site. The researcher was able to evaluate participants using the Consumer Behavior Code Sheet.

Experimental Design & Statistical Treatment

A 2 x 2 Factorial Experimental Design was utilized. There were two groups, store (consumers at the selected merchandise displays of two

independently owned non-urban stores) and two groups nested within store, lighting treatment (consumers under either the supplemental lighting treatment On or Off on test displays within each store).

The statistical method was Analysis of Variance (ANOVA) which was used to test for significant differences among the means of the three dependent variables (Time at Display, Number of Items Touched and Number of Items Picked Up) with the two independent variables: the supplemental lighting treatments (On or Off) and the stores (hardware and western apparel/feed) and to test for interactions. Bonferroni paired comparisons were calculated to determine where the differences existed among the means. Age was used as a covariate. Correlations among the dependent variables were calculated. Inter-rater agreement percentages were calculated for a preliminary screening of four raters, prior to the coding for the actual study. Spearman correlations were calculated on a subset of the study's two raters' observations for demographics and dependent variables.

Independent and Dependent Variables

The independent variables for the study were as follows:

1. Presence or absence of supplemental lighting
2. Store 1, hardware store; or Store 2, western apparel/feed store.

The dependent variables for the study were as follows:

1. Time at Display that consumers remained.

2. Number of Items Touched on the test display.

3. Number of Items Picked Up from the test display.

CHAPTER 4

RESULTS AND DISCUSSION OF THE STUDY

The purpose of this study was to determine the effect of in-store test display lighting on the approach-avoidance behavior of consumers. Findings may be useful to retailers in attracting consumers to merchandise, engaging consumers with merchandise and ultimately encouraging consumers to purchase. This information could be especially useful to retailers in non-urban areas due to their challenges in retaining consumers and the threat of out-shopping.

Pearsons correlations were calculated for Time at Display, Number of Items Touched, and Number of Items Picked Up after the data were collected, and results are presented in Table 1. As was anticipated, the dependent variables were highly correlated. This may be attributed to the necessity of a consumer remaining at the test display in order to touch an item and the necessity of a consumer remaining and touching a merchandise item, in order to pick it up from the display. In the previous research on which this study was based, (Areni & Kim, 1994), a dependent variable correlation between the number of items examined and the number of items handled was given as 0.49, but no significance was given. The researchers indicated that this correlation was expected due to their expectation that the handling of an item required it also to be examined.

Table 1

Pearsons Correlations for Dependent Variables

Source	TAD	NIT	NIP
TAD		.60***	.53***
NIT			.67***
NIP			

Note. TAD = Time at Display in Seconds; NIT = Number of Items Touched; NIP = Number of Items Picked Up.

*p < .05. **p < .01 ***p <.001.

Results

Interrater Reliability Results

A preliminary screening of potential raters was developed prior to the selection of the final raters for the study. Four raters watched 6 video taped in-store consumer episodes. They coded demographics and consumer behavior. Utilizing the method suggested by Touliatos and Compton (1988), interobserver agreement percentages were found for each of the demographic and dependent variables. As shown in Table 2, the percentages were over 70% for each demographic and dependent variable. These inter-rater agreement percentages were considered by the researcher to be an early indicator in support of interrater reliability.

Two of the raters who participated in the preliminary screening were chosen to identify and record the demographics and behavior of all 2367 consumers observed in the study. One of the raters was an educator and had prior professional experience with reviewing video tapes, timing and counting human behavior. The researcher was the other rater.

Additional tests of interrater reliability were performed on a sub-sample of the total data set. Observations of 50 subjects were selected and Spearman correlations were calculated between the two raters' observations of these subjects for all demographic and dependent variables. As shown in Table 3, the results of these interrater tests produced highly significant correlations on all

Table 2

Preliminary Screening Interrater Reliability Percentages

Source	Percentage
Demographics	
Age	87.5
Sex	100.0
Race	100.0
Dependent Variable	
TAD	96.0
NIT	75.0
NIP	100.0

Note. TAD = Time at Display in Seconds; NIT = Number of Items Touched; NIP = Number of Items Picked Up.

Table 3

Spearman Correlations for Rater Observations

Source	Correlation
Demographics	
Age	.78***
Sex	.95***
Race	1.00***
Dependent Variable	
TAD	.94***
NIT	.90***
NIP	1.00***

Note. TAD = Time at Display in Seconds; NIT = Number of Items Touched; NIP = Number of Items Picked Up.

*p < .05. **p < .01 ***p <.001.

demographics and dependent variables. Acceptable interrater reliability of the two raters was therefore considered to have been achieved.

Profile of Respondents

Demographic characteristics of age, sex and race were estimated by the two raters who watched the video tapes of consumers recorded in this study. A profile comparing the categorization by the two raters of the demographic characteristics of the 2367 consumers is shown in Table 4. As previously reported, the two raters for the study were shown to have high interrater reliability. The comparison table is provided as an aid in examining rater discrepancies. Of these three demographic variables, raters differed the most in their determination of consumer age which was the variable achieving the lowest interrater correlation. The categorization of age by raters differed mostly in the 20-39 and 40-59 year old age groups with rater 1 dividing consumers in these two groups almost equally while rater 2 assigned the majority of consumers to the younger age group. The categorization of sex and race by raters was virtually identical.

All of the demographic observations of both raters were summed in the creation of a demographic profile of consumers by store as shown in Table 5. In both the stores, over 40% of the consumers appeared to be 20-39 years old and approximately 30% appeared to be between 40 and 59 years old. In both stores a relatively small number of consumers appeared to be 12 or under or 60 or

Table 4

Demographic Profile of Respondents by Rater

Demographic Variable		Rater 1		Rater 2	
		n	%	n	%
Age					
	12 and under	229	9.7	239	10.1
	13 -19	158	6.7	209	8.8
	20-39	889	37.6	1244	52.6
	40-59	846	35.7	463	19.6
	60 and older	245	10.3	212	8.9
Sex					
	Male	1444	61.0	1436	60.7
	Female	923	39.0	931	39.3
Race					
	White	2065	87.2	2069	87.4
	Black	294	12.4	291	12.3
	Other	8	0.4	7	0.3
Total		2367	100.0	2367	100.0

Table 5

Demographic Profile of Respondents by Store

Demographic Variable		Store			
		Hardware		Western Apparel/Feed	
		n*	%	n*	%
Age					
	12 and under	118	7.8	350	10.9
	13 -19	70	4.6	297	9.2
	20-39	716	47.4	1419	44.0
	40-59	454	30.1	854	26.5
	60 and older	152	10.1	304	9.4
Sex					
	Male	1247	82.6	1631	50.7
	Female	263	17.4	1590	49.3
Race					
	White	1167	77.3	2968	92.1
	Black	338	22.4	246	7.6
	Other	5	0.3	10	0.3
Total		1510*	100.0	3224*	100.0

*Note: Totals include summed observations of both raters of 2367 consumers.

older. The category with the lowest number of consumers for both stores was the 13-19 year old age group.

In both store samples, the vast majority of subjects appeared to be white. A much smaller percentage appeared to be black. Less than 1% of consumers in both stores were classified by the raters as "other". These persons appeared to include native Indians or Hispanics. The sex of the consumers in the western apparel/feed store was divided approximately equally by the raters while over 80% of the consumers in the hardware store appeared to be male.

Approach-Avoidance Behavioral Results

Hypothesis 1: When the supplemental lighting treatment at the test display is illuminated, consumers will remain at the test display longer. This hypothesis was not supported.

As shown in Table 6, results from the Analysis of Variance (ANOVA) revealed a highly significant difference in the main effect of store. Consumers remained longer at the test display in the western apparel/feed store (M =13.44, SD = 27.65) than at the test display in the hardware store (M = 6.75, SD = 13.14). No significant difference was found in Time at Display by the main effect of supplemental lighting treatment.

The ANOVA of the interaction of store by supplemental lighting treatment revealed a highly significant difference in the Time at Display as shown in Table 6. To aid in determining where the significant differences were among the means, six Bonferroni paired comparison tests were performed.

Table 6

Analysis of Variance of Consumer Approach Behaviors at Test Displays

Source	df	F		
		TAD	NIT	NIP
Main Effects				
S	1	75.34***	33.16***	12.06**
L	1	1.19	3.95*	4.96*
2-Way Interaction				
S x L	1	11.15**	6.84**	13.53***
Covariate				
Age	1	9.21**	2.96	0.12
Error	4729	573.50	4.32	0.13

Note. S = Store; L = Lighting Treatment; TAD = Time at Display in Seconds; NIT = Number of Items Touched; NIP = Number of Items Picked Up.

*p < .05. **p < .01 ***p < .001.

Means and standard deviations are shown in Table 7. These results are also represented graphically in Figure 4. In the hardware store, consumers remained longer under the Off treatment than the On treatment. No significant differences in means were found for Time at Display between the On and Off treatments in the western apparel/feed store.

Significant differences in Time at Display by the covariate of age were also noted as shown in Table 6. To aid in determining where the significant differences were among the means, Bonferroni paired comparison tests were performed among the means for age, shown in Table 8. The 12 year old and under age group spent the longest time at the test displays in both stores.

Hypothesis 2: When the supplemental lighting treatment at the test display is illuminated, consumers will touch more merchandise on the test display. This hypothesis was partially supported.

A highly significant difference was found in Number of Items Touched by the main effect of store, as shown in Table 6. Consumers touched more items in the western apparel/feed store (M = .45, SD = 2.50) than in the hardware store (M = .10, SD = .51). A significant difference was noted for the main effect of supplemental lighting treatment. Consumers touched more items under the On supplemental lighting treatment (M = .41, SD = 2.4) than under the Off supplemental lighting treatment (M = .28, SD = 1.80).

Table 7

Means and Standard Deviations of Time at Test Displays

	Supplemental Lighting Treatment M (SD)	
Store	On	Off
Hardware	5.25[a] (7.62)	8.58[c] (17.50)
Western	14.49[be] (30.98)	12.82[de] (25.44)

Note. Means with different letters differ significantly at $p < .05$.

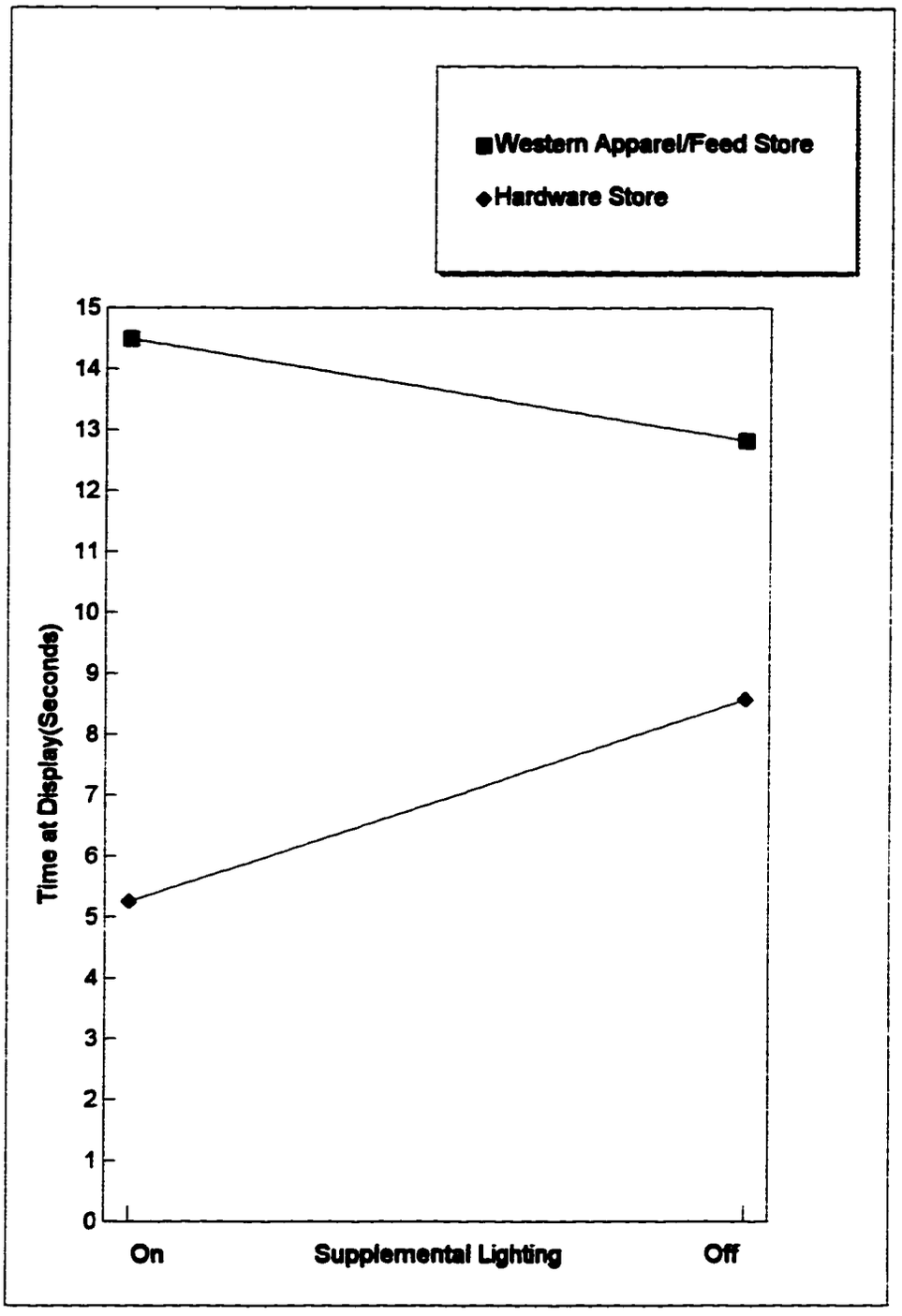

Figure 4. Means for Time at Display.

Table 8

Mean Time at Test Displays by the Covariate of Age

Age Group	Time in Seconds
12 or under	15.33[a]
13 -19	11.59[ab]
20-39	11.10[b]
40-59	10.77[b]
60 or older	9.51[b]

Note. Means with different letters differ significantly at $p < .05$.

The ANOVA of the interaction of store by supplemental lighting treatment revealed a highly significant difference in the Number of Items Touched as shown in Table 6. To aid in determining where the significant differences were among the means, six Bonferroni paired comparison tests were performed among the means for supplemental lighting treatment and store. The means and standard deviations are shown in Table 9, and the results are represented graphically in Figure 5. In the western apparel/feed store, consumers touched significantly more items under the On treatment than the Off treatment. No significant differences in means were found for Number of Items Touched between the On and Off treatments in the hardware store. As shown in Table 6, the results from the ANOVA indicated that there was not a significant difference in the Number of Items Touched by the covariate of age.

Hypothesis 3: When the supplemental lighting treatment at the test display is illuminated, consumers will pick up more merchandise from the test display. This hypothesis was partially supported.

A highly significant difference in Number of Items Picked Up was found by the main effect of store. Consumers picked up more items in the western apparel/feed store ($M = .06$, $SD = .42$) than in the hardware store ($M = .03$, $SD = .20$). A significant difference in Number of Items Picked Up was found by the main effect of supplemental lighting treatment. Consumers picked up more items under the On lighting treatment ($\underline{M} = .07$, $\underline{SD} = .45$) than under the Off lighting treatment ($\underline{M} = .04$, $\underline{SD} = .29$).

Table 9

Means and Standard Deviations of Number of Items Touched at Test Displays

	Supplemental Lighting Treatment M (SD)	
Store	On	Off
Hardware	0.08[a] (0.45)	0.12[ad] (0.57)
Western	0.63[b] (3.09)	0.33[cd] (2.06)

Note. Means with different letters differ significantly at $p < .05$.

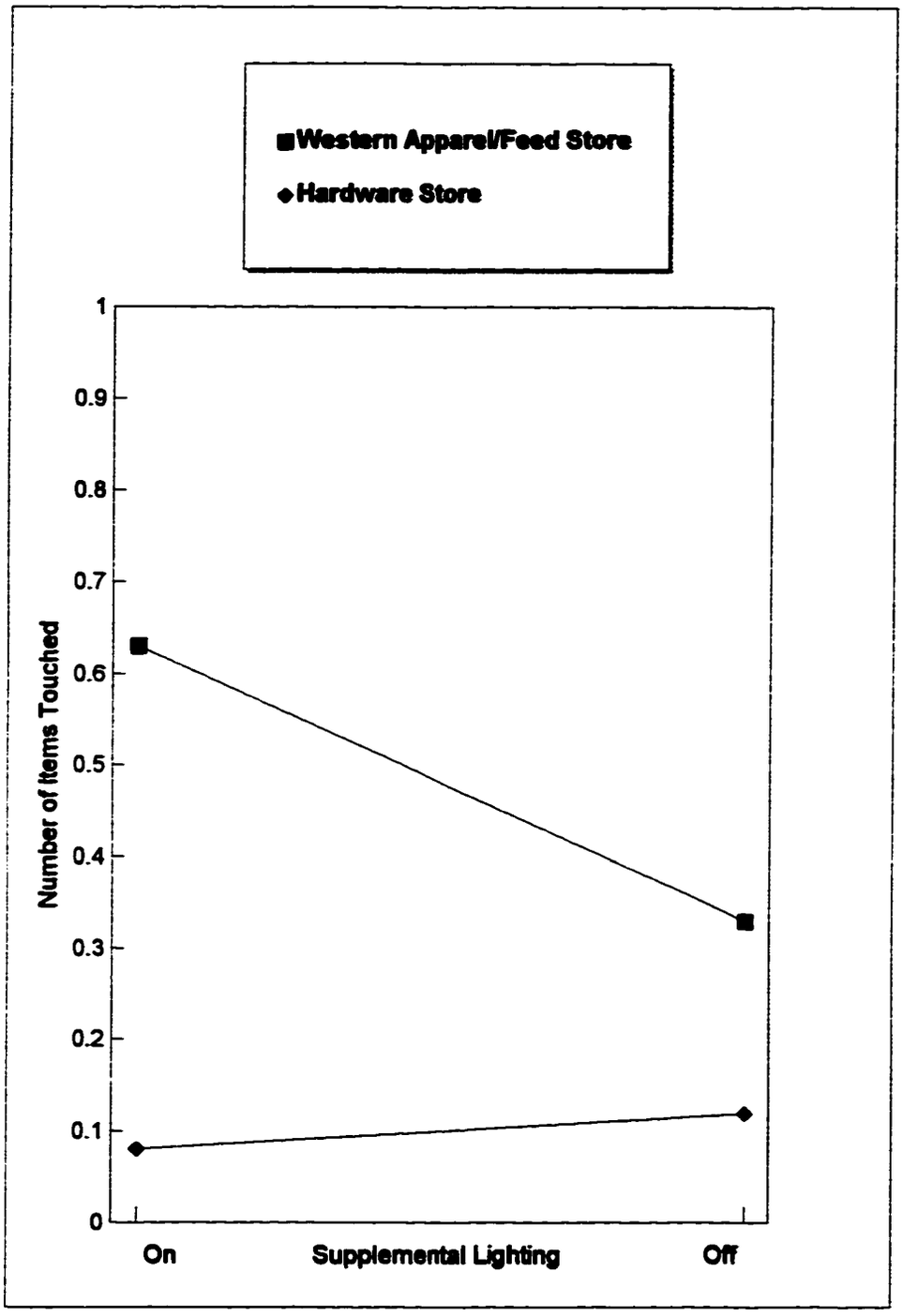

Figure 5. Means for Number of Items Touched.

As shown in Table 6, the ANOVA for the interaction of store by supplemental lighting treatment revealed a highly significant difference in the Number of Items Picked Up. To aid in determining where the significant differences were among the means, six Bonferroni paired comparison tests were performed. The means and standard deviations are shown in Table 10, and the results are represented graphically in Figure 6. In the western apparel/feed store, consumers picked up significantly more items under the On treatment than the Off treatment. No significant differences in means were found for Number of Items Picked Up between the On and Off treatments in the hardware store. The results from the ANOVA in Table 6 indicated that there was not a significant difference in the Number of Items Picked Up by the covariate of age.

General Hypothesis: When the supplemental lighting treatment at the test display is illuminated, consumers' approach behavior, relative to the test display, will increase. This hypothesis was partially supported based on the determination that two out of three of the specific hypotheses were partially supported.

Discussion

Research to quantify the impact of illumination on consumer behavior in actual retail environments could be beneficial since lighting is recognized as being an influential component of store atmospherics, affecting consumers' visual appraisal of everything in a store, including the merchandise. Illumination has

Table 10

Means and Standard Deviations of Number of Items Picked Up at Test Displays

	Supplemental Lighting Treatment M (SD)	
Store	On	Off
Hardware	0.02[a] (0.18)	.04[a] (0.22)
Western	0.11[b] (0.57)	.04[a] (0.30)

Note. Means with different letters differ significantly at $p < .05$.

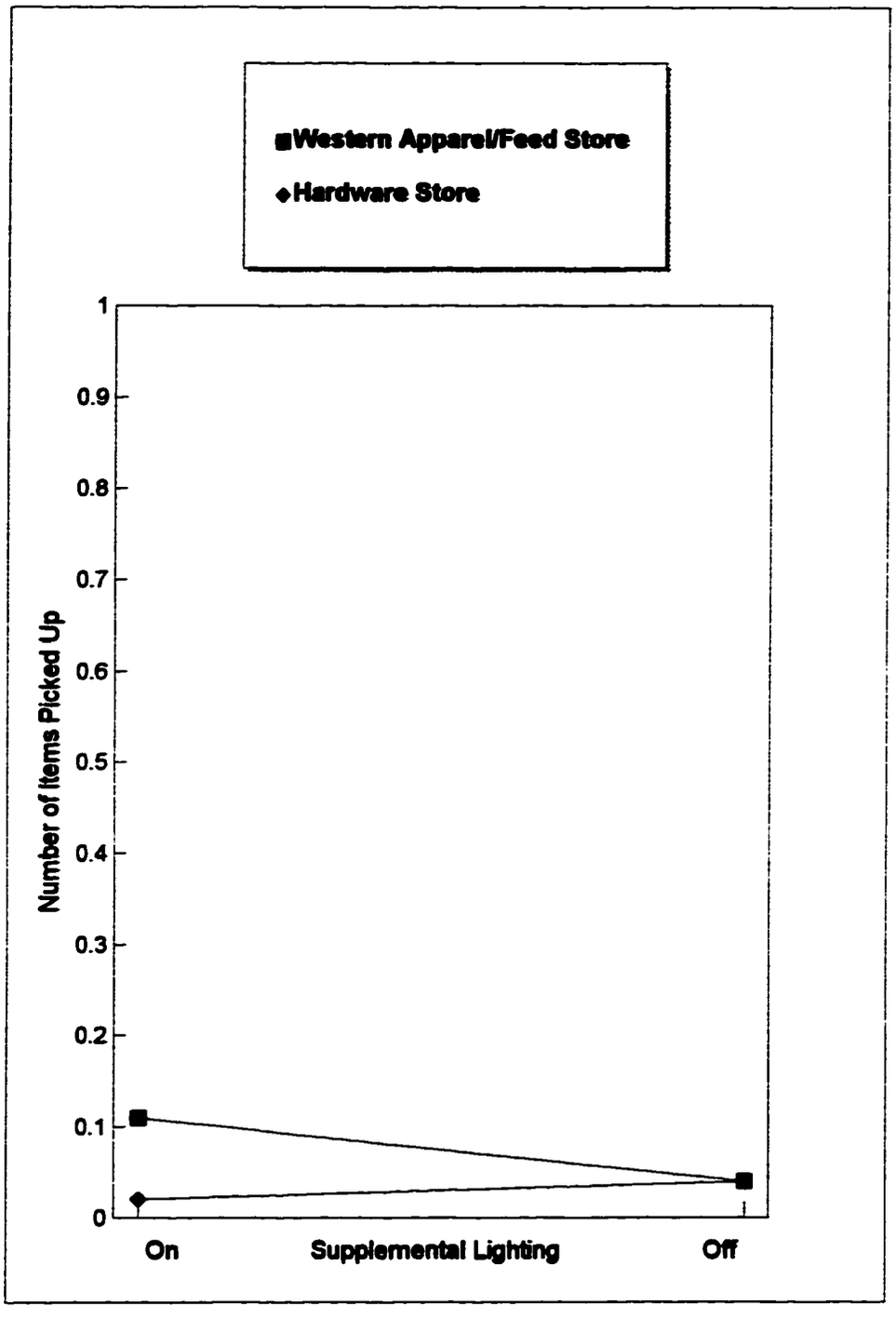

Figure 6. Means for Number of Items Picked Up.

been cited as contributing to in-store consumer perception, merchandise enhancement and store success, yet few empirical studies measuring the effect of retail lighting on consumer behavior have been published (Gobe, 1990; Lopez, 1995; Rea, 1993). Most of the retail research found in the review of literature addressing consumer perception or consumer behavior in relation to in-store atmospherics or aspects of the environment relied upon consumer role play, laboratory settings, or memory-recall (Baker et al., 1992; Bitner, 1990).

A major contribution of the current research is the establishment of a reliable methodology for the study of lighting's influence on consumer approach-avoidance behavior. A procedure for observing and documenting consumer behavior was developed and tested. In the development of this methodology, rater interpretations for consumer behaviors were standardized.

In this study, large variances were noted for Time at Display, Number of Items Touched, and Number of Items Picked Up. The standard deviations were always higher than the means for these dependent variables. This finding may be attributed to the large numbers of "passersby" recorded in the measurement zones. Soon after the review of the video tapes began, the raters observed that the great majority of consumers merely walked by the test displays without pausing. The average time that an adult required to merely walk past the stores' test displays and traverse the video cameras' measurement zones was found to be approximately three seconds. These subjects were deemed, "passersby", and were coded as three seconds for the dependent variable, Time At Display.

Subjects who stood or walked in front of a test display without turning their heads towards the display were also counted as passersby. This coding procedure was followed regardless of whether the supplemental lighting treatment was On or Off. These consumers may have been visiting with others or disciplining children while coincidentally remaining in the measurement zone. The researcher believed it important to the integrity of this exploratory study to retain data on these passersby as they served as a reference group, seemingly unaffected by the independent variables.

Most passersby had no physical contact with the merchandise on the test displays as compared to the relatively few consumers who remained for several minutes in the measurement zone, touching and picking up many merchandise items. The large variances reflected the great diversity of consumer behavior observed in the study. Further, the means for Number of Items Touched and Number of Items Picked Up are fractions due to the overwhelming percentage of subjects who did not touch or pick up any merchandise. These fractional means reflected the large variances in consumer behavior. In future studies, researchers may wish to eliminate passersby and/or subjects who do not touch or pick up merchandise to help reduce the variance.

In this exploratory study, data on all subjects, regardless of age, were retained and reported. Consumers' age influenced Time At Display but did not influence Number of Items Touched nor Number of Items Picked Up. Children spent relatively more time at the test displays than older consumers. They were

observed playing at the test displays in both stores. Children in the hardware store may have been further enticed to remain within the video camera's measurement zone due to the close proximity of gum ball machines to the test display. In future studies, researchers may wish to eliminate children from their research, especially if the retail store studied does not include children in its target market. Generally speaking, age was found by the raters in this study to be difficult to judge by watching video tapes. Future researchers may choose to determine age by some other means or may choose to eliminate the classifications of age except, perhaps, as a distinction between children and adults.

Findings from this study indicated that light levels do contribute to consumer approach behavior. Like Areni and Kim's (1994) findings that consumers examined and handled more items under "bright lighting" than under "soft lighting", the results of this study showed that there was a significant increase in the Number of Items Touched and the Number of Items Picked Up from the test display under the On lighting treatment in the western apparel/feed store. Based on these findings, there is an indication that when the supplemental lighting treatments were illuminated, consumer approach behaviors increased. This finding supported approach-avoidance theory (Mehrabian, 1976) which posited that environmental stimuli would produce arousal and pleasure and increase approach behaviors.

However, the study found differences in consumer behavior under the lighting treatments as qualified by store. No previous studies were found which examined more than one store type concurrently or which studied hardware or western apparel/feed stores. Thus, there were no references with which to compare this study's findings.

Perhaps, the lighting in both stores did not possess sufficient contrast between the ambient and merchandise display lighting conditions to make a real difference in consumers' contrast detection. The test display merchandise may not have "stood out" against the stores' relatively highly illuminated backgrounds. Consumers' approach behavior may have been influenced by the weak lighting contrasts between merchandise lighting and ambient lighting. The Illuminating Engineering Society of North America Handbook (Rea, 1993) discusses the concept of contrast threshold as a way "...to illustrate the fundamental relationship between object detection and the luminances of the background...", p. 86. The Handbook (Rea, 1993) further states "...as the background luminance (and therefore the retinal illuminance) increases, the contrast threshold decreases, rapidly at first and then more slowly...", p. 87. Human visual systems are designed to react to changes in illumination within the visual field, and these changes may be thought of as contrasts. "Contrast detection is a basic visual task from which many other visual behaviors are derived", p. 86, (Rea, 1993). Therefore, consumers could gain visual information from a retail environment based on the visual contrast between the ambient lighting and the merchandise

display lighting thus influencing their approach behaviors. Further study is needed to test the influence of contrast threshold.

The effect of store may include several factors which could potentially influence consumer approach behavior. Merchandise content, need or lack of need to try on merchandise, and pricing methods may be important influences in concert with light levels. Tools in the hardware store, as compared to belts in the western apparel/feed store, may have inherently required less time for consumer selection. Only one or two different types of each tool were offered as compared to many styles and sizes of belts. Tools from the hardware store did not require size compatibility. Belts, however, were often tried on in the western apparel/feed store in front of the test display. This required consumers to remain at the test display and may have contributed to the longer Time at Display noted in the western/apparel feed store. Additionally, in the hardware store, prices for the tools were found on the front face of the bins on the shelves of the tool display fixture. Consumers did not have to spend much time in determining prices in the hardware store. In the western apparel/feed store, however, pricing was indicated only on the back side of individual belts with prices missing on some of the belts. No prices were displayed on the belt display fixture. In order to determine prices, consumers were required to inspect individual merchandise items. Where prices were not indicated on the selected merchandise items, consumers may have been required to refer to additional, similar merchandise display items for prices. Thus, pricing method may have

encouraged consumers to remain at the test display longer than if merchandise prices was displayed clearly on bins or on the display fixture.

More items were touched and picked up in the western apparel/feed store under the On lighting treatment than were touched and picked up in the hardware store. Perhaps, as discussed earlier for Time at Display, the lighting in the hardware store did not have enough contrast between the ambient and the display lighting to make a difference in the Number of Items Touched and Picked Up. In the hardware store, the average ambient light level was measured to be 22.45 footcandles. The IES recommended ambient level is 10 footcandles. The average light level measured on the test display with the Off treatment was 23.64 footcandles. With the On treatment 47 footcandles was measured. The IES recommended level is 30 footcandles. Other factors not related to the lighting may have affected consumer touching behavior. Consumers may have wanted or needed more hands-on experience to appraise the western apparel/feed store merchandise (belts on the test display) than the merchandise in the hardware store (tools). The overall merchandise content, the need to try on merchandise and the individual pricing of belts, as discussed earlier for Time at Display, could have also influenced consumers to touch and pick up more merchandise items in the western apparel/feed store than in the hardware store. Additional research is suggested to explore these interactions.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this study was to determine the effect of lighting in actual merchandise display areas on the approach-avoidance behavior of consumers. This information is important because it could be used by retailers to aid in attracting consumers to the merchandise, in engaging consumers in appraising the merchandise and thus ultimately encouraging them to purchase the merchandise.

The influence of lighting on the following three aspects of approach-avoidance consumer behavior was measured in this study:

1. a desire to approach (to remain at) the merchandise display or to avoid (to leave) the test display,
2. a desire or willingness to explore the test display (to touch the merchandise) or to not explore the test display, and
3. the degree of approach (enhancement) or avoidance (hindrance) of the task of picking up items from the test display.

The study examined the effect of the independent variables of supplemental lighting treatments (On and Off) applied in actual store settings (a hardware store and a western apparel/feed store), on the dependent variables of length of Time at Display, Number of Items Touched and Number of Items Picked Up from the test display by consumers.

Two independently owned, non-urban retail stores were studied for two consecutive Friday and Saturday eight hour periods during the month of December 1996. Video cameras were located in the stores to record consumer behavior at test displays under alternating On and Off lighting treatments. These treatments were counterbalanced such that the data were collected during one Friday and one Saturday each with the On treatment, and one Friday and one Saturday each with the Off treatment. The video tapes were watched off-site and consumer behaviors and demographics were evaluated. The review of the video tapes and the timing and recording of data onto coding sheets were performed by two raters simultaneously. The demographics and consumer behavior of a total of 2367 consumer subjects were reviewed, and interrater reliability for each variable was determined to be high. The consumers in both stores in the study were observed to be mostly white, with a smaller percentage of blacks and a very small percentage of other races represented. Over 70% of the consumers in both stores were between 20 and 59 years old. The majority of the consumers in the hardware store appeared to be men, but almost equal numbers of men and women were observed in the western apparel/feed store.

The behavioral characteristics of consumers were evaluated using ANOVA and paired comparison tests. Three specific hypotheses and one General Hypothesis were tested. Hypothesis 1 posited that as the light level on the test display was increased, consumers would spend more time at the test display. Based on the results, this hypothesis was not supported. Hypothesis 2

posited that as the light level on the test display was increased, consumers would touch more merchandise on the test display. Based on the results, this hypothesis was partially supported. Hypothesis 3 posited that as the light level on the test display was increased, consumers would lift more merchandise from the test display. Based on the results, this hypothesis was partially supported. The General Hypothesis posited that as the light level on the test display was increased, consumers would increase their approach behavior. Based on the partial acceptance of two of the three specific hypotheses, the General Hypothesis was partially supported.

Conclusions

The following conclusions were drawn from this study:

1. Approach-avoidance theory was applied to a retail setting and appeared to be an effective way of explaining consumer behavior. Building on the research by Areni and Kim (1994) and Mehrabian (1976), this study furthered the development of methodology utilizing Mehrabian and Russell's (1974) theory of approach-avoidance behavior.
2. Supplemental merchandise display lighting did contribute to the approach behaviors of consumers at the test displays. As qualified by store, consumers touched and picked up more items under the On lighting treatment.
3. A significant interaction between lighting treatment and store type was noted. The temporary supplemental lighting treatments installed over the

merchandise displays seemed to have an effect on consumer behavior, but this was qualified by store and treatment. In one store, more approach behaviors were observed under the Off treatment than the On treatment. However, the reverse was noted in the other store. The idiosyncrasies of each store, merchandise type, pricing method, need or lack of need to try on merchandise, and ambient lighting may have also impacted the interactions.

4. Based on this study's methodology, consumer behavior was able to be empirically measured. Consumer approach/avoidance behavior at the merchandise test displays was able to be timed and counted by raters who examined video tape documentation from actual retail settings.

Implications

This study provided a sound methodology for the further examination of the effect of lighting on in-store consumer behavior. Based on approach-avoidance theory (Mehrabian, 1976), this study extended the lighting research begun by Areni and Kim (1994) in retail field settings. Unlike previous studies, this study's methodology included a full documentation of the physical conditions of the test store's interiors. The physical characteristics found in the environments of the entire population of stores may vary widely, and lighting involves a complex combination of qualitative and quantitative factors within these stores. More research is needed to test the limits of the ability to generalize from this study's results, but other researchers will be able to use the

description of the stores' physical conditions as a benchmark for their replications.

The validity of this study may be higher than some other behavioral studies which utilized laboratory mock ups or memory recalls. The actual store environments utilized in this study were realistic settings in which to test hypotheses about consumer behavior. Additionally, this study also included a relatively large number of subjects, 2367 participants from two different types of stores, hardware and western apparel/feed.

Based on the findings from this study, retailers could supplement the illumination on their merchandise displays in compliance with industry recommendations for their store type in order to attract consumers and involve them in their merchandise. Generally, retailers could expect positive consumer involvement including an increase in the number of items that the consumers touch on merchandise displays and an increase in the number of items that the consumers pick up from merchandise displays.

Positive effects on consumers' approach behavior relative to merchandise displays could be achieved with the retailers' installation of temporary, portable fixtures as utilized in this study. These lighting fixtures are readily available at a relatively low cost from home improvement stores. Based on this study, a retailer's manipulation of the in-store supplemental display lighting may achieve a significant increase in general consumer involvement with in-store display merchandise.

Recommendations for Future Research

Due to the limited amount of scholarly research in this area, the current study supports the need for further field investigation into the impact of lighting on consumer behavior. The cooperation of retailers with researchers is especially important to facilitate study. The following recommendations for future research are made:

1) Replicate the study utilizing different ambient lighting levels and different display merchandise lighting levels. Both higher and lower levels than those utilized in the current study should be investigated in order to determine the thresholds of the effects of lighting on consumer behavior.
2) Future research could include replication of the current study with an attempt to gather consumer purchase data. Consumer purchase behavior is complex and is affected by many factors beyond lighting and the other influencers of store atmospherics. Controlling for other variables while varying the illumination in actual retail settings and observing consumer behavior is recommended.
3) Replicate the study in stores which offer merchandise types other than that which was studied herein. Continue to build on the methodology established in the current study while observing consumer behavior in retail apparel settings is recommended. Concurrently studying multiple chain-stores which offer virtually identical goods in identical environments with identically configured and located merchandise

displays while varying the merchandise display lighting treatments would be ideal.

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APPENDIX

*IRB accession #:*_____ *LSU Proposal #:*_____

LSU/PBRC: HUMAN RESEARCH SUBJECTS

APPLICATION FOR EXEMPTION FROM INSTITUTIONAL OVERSIGHT

ALL LSU/PBRC research using living human subjects, or samples or data, obtained from them, directly or indirectly, with or without their consent, must either be approved in advance by the LSU/PBRC Institutional Review Board (IRB), or be found to meet narrow criteria for exemption from IRB oversight by a designated committee.

This Form will help the PI to determine if the project is likely to meet the criteria for exemption, to present the case for exemption to a Screening Committee, and to document the decision on the request. NOTE: A determination of Exempt status does not release the researcher from exercise of prudent practice in protecting the interests of research subjects. *Whether exempt or not, the research must be conducted according to the Ethical Principles and Guidelines for the Protection of Human Subjects (the Belmont Report, available from the Office of Sponsored Research); you must be familiar with the Principles.*

Instructions: Complete checklist, pp 2-4. If project appears to qualify for exemption, complete this page and forward 2 ccs of entire form and a detailed project description adequate to document the responses in Parts A & B to a Screening Committee or IRB member. If ineligible for exemption, submit to IRB (see foot p. 4).

Principal Investigator Paulette R. Hebert

Department/Unit Human Ecology (merchandising) Ph: 388-1524

Project Title The Impact of Lighting Design in Retail Settings on Consumer Behavior

Agency expected to fund project Fellowship Money will be sought } Rate application thereof this office attach this approval CC.

I certify that the following responses are an accurate representation of the character of the project as planned. (If the project scope or design is later changed I will resubmit for review):

Signature Paulette R Hebert Date 9/17/96 Principal Investigator (no per signatures)

Screening Committee Action: Exempted ✓ Not Exempted ___ *

Name C. S. BAHAM Signature C S B Date 9/18/96

*Note reason; PI must send to IRB for review (See foot p. 4)

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cc PI; Chair, IRB; IRB Screening Committee file (w. protocol).

Part A:. DETERMINATION OF "RESEARCH" and POTENTIAL FOR RISK

This section determines whether the project meets the Department of Health and Human Services definition of "research" and if not, whether it nevertheless presents more than "minimal risk" to humans that requires LSU to exercise prudence by requiring IRB review.

1. Is the project a systematic investigation designed to develop or contribute to generalizable knowledge?

(Note "systematic investigation" includes "research development, testing and evaluation"; therefore some instructional development and service programs will include a "research" component).

YES✓ Go to Part B: Project constitutes research

NO_____ Go to 2

2. Does the project present physical, psychological, or legal risks to the participants reasonably expected to exceed those risks normally experienced in daily life or in routine physical or psychological examination or testing?

YES_____ Check C 2 and stop here: IRB review required

NO_____ Check C 1 Not subject to IRB oversight

Part B: EXEMPTION CRITERIA FOR RESEARCH PROJECTS

This Part establishes whether the project is confined to categories of research activity that may be exempted from IRB oversight.

1. Is this research conducted in established or commonly accepted educational settings, involving normal educational practices (e.g. research on regular and special education strategies; research on the effectiveness of, or comparison among instructional techniques, curricula or classroom management methods)?

YES✓ Go to 2: This exemption criterion is satisfied

NO_____ Go to 2

2. Will this research use educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior?

YES✓ If minors (<18y) are subjects of survey or interview procedures, or of observations of public behavior in which the observer participates, the protocol may not be exempted: Check C 2, and go to 3 to complete questionnaire. Otherwise go to 2.1

NO_____ Go to 3

2.1 Is the information recorded in such a manner that human subjects can be identified directly, or through identifiers linked to the subjects (such as a code system with a key kept by the PI)?

YES____ Go to 2.2

NO✓____ Go to 3: This exemption criterion is satisfied

2.2 Will any disclosure of the human subjects' responses have the potential to place the subjects at risk of criminal and civil liability, or be damaging to the subjects' financial standing, employability or reputation?

(The collection of sensitive data regarding the subjects' (or relatives' or associates') possible substance abuse, sexuality, criminal history or intent, medical or psychological condition, financial status, or similarly compromising information are examples of instances which will require an answer of YES):

YES____ Go to 2.3

NO____ Go to 3: This exemption criterion is satisfied

2.3 a) Do federal statute(s) exist that require without exception that the confidentiality of the personally identifiable information in this specific study or data set be maintained during and after the research (unlikely) OR are the human subjects elected or appointed public officials or candidates for public office? (Explain:_____)

YES____ Go to 3: This exemption criterion is satisfied

NO____ Check C 2 go to 3: IRB review required

3. Does this research involve the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens?

YES____✓ Go to 3.1

NO✓____ Go to 4

3.1 Is this material or information publicly available, or will it be recorded in such a manner by the investigator that the subjects cannot be identified directly or through identifiers linked to the subjects?

YES____ Go to 4: This exemption criterion is satisfied

NO____ Check C 2 & go to 4: IRB review required.

4. Is this a research or demonstration project *conducted by, or subject to the direct approval* of* the head of Health and Human Services or other federal Agency, and which is designed to study:

4.1 Public benefit or service programs, or with respect to such programs
4.2 Procedures for obtaining program benefits/services, or
4.3 Possible changes in the programs or procedures, or
4.4 Possible changes in payment for benefits/services?

* *(receipt of a research award does not constitute such approval)*

YES____ Go to 5: This exemption criterion is satisfied

NO ✓ Go to 5

5. Is this a taste or food evaluation or consumer acceptance study?

YES____ Go to 5.1

NO ✓ Go to 6

5.1 Will only wholesome foods without additives be consumed? OR any food ingredients (including additives) consumed will be demonstrably at or below the level, and for a use found to be safe; are agricultural chemicals or environmental contaminants demonstrably at or below the level found to be safe by the Food and Drug Administration or approved by the Environmental Protection Agency or the USDA Food Safety and Inspection Service?

YES ____ Go to 6: This exemption criterion is satisfied

NO, or unsure_____ Check C 2 & go to 6: IRB review required

6. Does the project include ANY research activity with humans not specifically exempted under <u>one or more</u> of the above criteria?

YES____ Check C 2: IRB review required

NO ✓ Check C 1: Project may be exempted

Part C: PRELIMINARY EVALUATION of EXEMPT STATUS by Investigator:

1. ✓ This project CAN be exempted from IRB Review (subject to Screening Committee confirmation). Forward 2 copies of this form and the protocol to the Screening Committee or IRB Chair.

2. ____ The project MUST be submitted to the IRB for review *

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* *Send signed original IRB protocol forms packet and 10 copies, plus one cc of any associated grant application to Dr. C. Graham, IRB Chair, 117 David Boyd Hall, LSU.* irbexem.w5/ibm 08/05/96

VITA

Paulette Robert Hebert was born November 17, 1957, in Baton Rouge, Louisiana. In December, 1979 she received her Bachelor of Interior Design degree from Louisiana State University. In May, 1992 she received her Master of Science degree from Louisiana State University in Human Ecology. Ms. Hebert was employed as a lighting designer by consulting engineering firms from 1979 to 1988. At that time she began her own firm, Paulette Hebert Lighting Consultants, Inc., through which she continues to design lighting systems for retail spaces and other building types. From 1986 to 1995 she served on the faculty of the Louisiana State University Interior Design Department. From 1995 to the present she has served on the faculty of the University of Southwestern Louisiana's School of Architecture, in Lafayette, Louisiana. She is currently a member of the Illuminating Engineering Society, the Interior Design Educators' Council and the Louisiana State Board of Examiners of Interior Designers. Ms. Hebert holds membership in Kappa Omicron Nu, Phi Upsilon Omicron and Gamma Sigma Delta honor societies. Her articles and projects have been published in international design magazines. In the Fall of 1992 she entered the doctoral program. Ms. Hebert expects to be awarded the Doctor of Philosophy degree from the School of Human Ecology in Merchandising with a Minor in Marketing.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Paulette R. Hebert

Major Field: Human Ecology

Title of Dissertation: Approach-Avoidance Behavior of Consumers as Influenced by Existing and Supplemental Merchandise Display Lighting

Approved:

Teresa A. Summers
Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Joseph F. Hair Jr.

Thomas C. Lawrence

James Honeycutt

Billie Collier

Charles M. Mayo

Date of Examination:

May 5, 1997